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Specifications

1. Title of invention

Manuscript [document] reading device

2. Scope of patent claims

In a manuscript [document] reading device having

a light source which irradiates light onto an object,

a reading means which detects the light reflected from the object onto which light has been irradiated from the above-mentioned light source, and

a transport means which moves the above-mentioned reading means relative to the above-mentioned object,

[we claim]

a manuscript [document] reading device characterized in that it has

a first standard plate which is read by the above-mentioned reading means prior to the start of reading the manuscript, and

a second standard plate which is read by the above-mentioned reading means after the completion of reading the manuscript, and

a correction means which corrects the post-correction [sic] pixel output value to a value V calculated using the following formula:

$$V = \frac{A\{V_i - (D_1 + D_2)/2\}}{\{(W_1 + W_2)/2\} - \{(D_1 + D_2)/2\}}$$

here, W_1 is the pixel output value of the above-mentioned reading means when the above-mentioned first standard plate has been read with the above-mentioned light source turned on prior to the start of manuscript reading, W_2 is the pixel output value of the above-mentioned reading means when the above-mentioned second standard plate has been read with the above-mentioned light source turned on after the completion of manuscript reading, D_1 is the pixel output value of the above-mentioned reading means when the above-mentioned first standard plate has been read with the above-mentioned light source turned off prior to the start of manuscript reading, D_2 is the pixel output value of the above-mentioned reading means when the above-mentioned second standard

plate has been read with the above-mentioned light source turned off after the completion of manuscript reading, V_i is the pixel output value of the above-mentioned reading means when the manuscript has been read with the above-mentioned light source turned on, and A is a preset constant.

3. Detailed description of the invention

[Area of industrial use]

This invention relates to a manuscript [document] reading device which uses a light source to irradiate light onto a manuscript and then reads the image.

[Conventional technology]

A conventional method for correcting the output in this kind of manuscript [document] reading device is disclosed in Official Gazette for Tokko [abbreviation, perhaps Patent Publication] No. Sho 61-14702. This method is a correction method which minimizes the dispersion of the output among each pixel of the image sensor, and in which the pixel output value of image sensor D is expressed by the following formula (1):

$$D = A \ (D_i - D_{id}) \ / \ (D_{iw} - D_{id}) \quad \text{... Formula (1)}$$

here, out of each pixel output of the digitalized image sensor, D_{iw} is the pixel output value when a certain amount of light is irradiated onto a standard white color plate, D_{id} is the pixel output value when a certain amount of light is not irradiated onto a standard white color plate (dark), D_i is the pixel output value when the manuscript has been read, and A is a preset constant.

[Problems which the invention attempts to resolve]

However, a conventional manuscript [document] reading device which performs corrections in the above-mentioned formula (1) has the following problems.

When an LED is used as a light source, for example, and the LED is continuously on, the temperature of the LED increases, and the light-emitting output of the LED, which has a negative temperature characteristic [coefficient], decreases. Because of this, even if a standard white color plate is read at the read start time, and a pixel output value D_{iw}--which becomes the standard--is obtained, as the light continues to remain on, the light-emitting output of the LED lowers at the read complete time, presenting the problem that the manuscript read result at the read complete time is dark.

When a fluorescent tube is used as the light source and the fluorescent tube is continuously on, the temperature of the fluorescent tube increases, and the light-emitting output of the fluorescent tube, which has a positive temperature characteristic [coefficient], increases over time as the light continues to remain on. Because of this, the light-emitting output at the read complete time increases, and the manuscript read result at the read complete time is too light.

So, this invention was pursued to resolve the above-mentioned problems found in conventional technology, with the purpose of providing a manuscript reading device which is capable of high precision image reading via correcting the output, taking the temperature characteristics of the light source into consideration.

[Means to resolve the problem] This invention is a manuscript [document] reading device having a light source which irradiates light onto an object, a reading means which

detects the light reflected from the object onto which light has been irradiated from the above-mentioned light source, and a transport means which moves the above-mentioned reading means relative to the above-mentioned object, with the manuscript [document] reading device characterized in that it has a first standard plate which is read by the above-mentioned reading means prior to the start of reading the manuscript, and a second standard plate which is read by the above-mentioned reading means after the completion of reading the manuscript, and a correction means which corrects the post-correction [sic] pixel output value to a value V calculated using the following formula (2):

$$V = \frac{A\,(V_i - (D_1 + D_2)/2)}{((W_1 + W_2)/2) - ((D_1 + D_2)/2)} \quad \text{... Formula (2)}$$

here, W_1 is the pixel output value of the above-mentioned reading means when the above-mentioned first standard plate has been read with the above-mentioned light source turned on prior to the start of manuscript reading, W_2 is the pixel output value of the above-mentioned reading means when the above-mentioned second standard plate has been read with the above-mentioned light source turned on after the completion of manuscript reading, D_1 is the pixel output value of the above-mentioned reading means when the above-mentioned first standard plate has been read with the above-mentioned light source turned off prior to the start of manuscript reading, D_2 is the pixel output value of the above-mentioned reading means when the above-mentioned second standard plate has been read with the above-mentioned light source turned off after the completion of manuscript reading, V_i is the pixel output value of the above-mentioned reading means when the manuscript has been read with the above-mentioned light source turned on, and A is a preset constant.

[Operation]

In this invention, prior to the start of reading the manuscript [document], the first standard plate is read both while the light source is turned on and turned off; and after the manuscript reading is completed, the second standard plate is read both while the light source is turned on and turned off. And the post-correction pixel output value is corrected to value V calculated by the above-mentioned formula (2), where W_1 is the pixel output value of the reading means when the first standard plate has been read with the light source turned on, W_2 is the pixel output value of the reading means when the second standard plate has been read with the above-mentioned light source turned on, D_1 is the pixel output value of the reading means when the first standard plate has been read with the light source turned off, D_2 is the pixel output value of the reading means when the second standard plate has been read with the light source turned off, V_i is the pixel output value of the reading means when the manuscript has been read, and A is a preset constant. In this way, the read data on the standard plates is gathered before and after reading the manuscript; and based on this, the pixel output value is corrected, so that the read signal is corrected, taking into account the changes in the light emission amount due to the increase in the light source temperature.

[Embodiment]

The following is an explanation of the invention relating to an embodiment shown in figures.

Figure 1 is a simplified diagram of the composition of a light source switching-type color manuscript reading device, which is an embodiment of the manuscript reading device related to this invention.

As shown in this figure, the manuscript reading device of the embodiment is equipped with manuscript mounting glass 2, on which manuscript P is placed, on the top surface of device main body 1, and also equipped with under-manuscript mounting glass 2 in device main body 1, optical reader 3, which moves in the arrow direction by a transport means, such as a belt drive mechanism, etc. (not shown in the figure), and reads the image of manuscript P. Moreover, in this embodiment, standard white color plates 4 and 5 on manuscript mounting glass 2 are provided respectively above the manuscript reading pre-start position (3a indicated by the broken line in the figure) and the manuscript reading post-complete position (3b indicated by the broken line in the figure) of optical reader 3.

Figure 2 is a simplified diagram of the composition of optical reader 3 in Figure 1.

As shown in this figure, optical reader 3 has blue color light source 6, green color light source 7, and red color light source 8, which illuminate manuscript P, a lens array 9 which converges the light reflected from manuscript P, and light receiving element 10, consisting of a CCD, which receives the reflected light converged by this lens array 9.

Figure 3 is a timing chart that explains the method for correcting the manuscript reading operation and read signals in this embodiment.

The following is an explanation of the operation of this embodiment, referring to Figure 1 to Figure 3.

First, when the read operation begins at the point indicated by START in Figure 3, in time period t_1, light sources 6, 7, and 8 are turned off, standard white plate 4 is read by light receiving element 10, and black data made of blue, green, and red color components (output values D_{B1}, D_{G1}, D_{R1}) is output.

Next, in time period t_2, as shown in a-c in Figure 3, light sources 6, 7, and 8 are turned on in that order, standard white plate 4 is read by light receiving element 10, and white data made of blue, green, and red color components (output values W_{B1}, W_{G1}, W_{R1}) is output.

Then, in time period t_3, as shown in a-c in Figure 3, light sources 6, 7, and 8 are turned on in that order, manuscript P is read by light receiving element 10, and image data made of blue, green, and red color components (output value B_i, G_i, R_i; i is the number of lines read) is output.

After completing the manuscript reading, in time period t_4, as shown in a-c in Figure 3, light sources 6, 7, and 8 are turned on, standard white plate 5 is read by light receiving element 10, and white data made of blue, green, and red color components (output value D_{B2}, D_{G2}, D_{R2}) is output.

Next, in time period t_5, light sources 6, 7, and 8 are turned off in that order, standard white plate 5 is read by light receiving element 10, and black data made of blue, green, and red color components (output value W_{B2}, W_{G2}, W_{R2}) is output, and the END point is reached, thus completing the reading.

The data for correction output in time periods t_1, t_2, t_4, and t_5, and the image data output in time period t_3 are sent to the correction circuit (not shown in the figure), and a correction operation for each color component of the image data where the manuscript

was read is executed according to the following formulas (3), (4), and (5). Here, A is a preset constant.

Blue color component:

$$V_{Bi} = \frac{A\{B_i - (D_{B1}+D_{B2})/2\}}{\{(W_{B1}+W_{B2})/2\} - \{(D_{B1}+D_{B2})/2\}}$$

... Formula (3)

Green color component:

$$V_{Gi} = \frac{A\{G_i - (D_{G1}+D_{G2})/2\}}{\{(W_{G1}+W_{G2})/2\} - \{(D_{G1}+D_{G2})/2\}}$$

... Formula (4)

Red color component:

$$V_{Ri} = \frac{A\{R_i - (D_{R1}+D_{R2})/2\}}{\{(W_{R1}+W_{R2})/2\} - \{(D_{R1}+D_{R2})/2\}}$$

... Formula (5)

As above, the read data on the standard white plates is gathered before and after the reading of the manuscript; and pixel output values V_{Bi}, V_{Gi}, V_{Ri}, in which corrections were made for the manuscript read data based on this, are obtained. So, even if the light-emission amount of the light source gradually changes due to the continuous illumination from the light source, the read data signals can be corrected by taking this change in the amount of light into consideration, making it possible to improve color errors of the read image caused by any differences in the light emission power of the light source.

Incidentally, the correction data [illegible, perhaps numeral "1"] output in time periods t_1, t_2, t_4, and t_5 are the values determined by the average of multiple line outputs in actuality, but Figure 3 shows a case in which 2 lines have been read.

In the above-mentioned embodiment, an explanation was given with a color manuscript reading device as an example, but [this invention] can be applied to a black and white manuscript reading device which uses a light source having a temperature characteristic, such as a LED, fluorescent tube, etc.

[Effect of the invention]

As explained above, according to this invention, correction data is gathered when the light source is both turned on and off before the start and after the completion of manuscript reading, and corrections are made based on this, so that even if a temperature change in the light emission amount of the light source occurs during reading the manuscript, read data errors can be improved, enabling high precision image reading, which is the effect of this invention.

[4. Brief explanation of drawings]

Figure 1 is a simplified diagram of the composition of an embodiment of the manuscript reading device related to the invention.

Figure 2 is a diagram of the composition of the optical reader in Figure 1.

Figure 3 is a timing chart that explains the method for correcting the manuscript reading operation in this embodiment.

1: Device main body, 2: Manuscript mounting glass, 3: Optical reader, 4, 5: Standard white color plate, 6: Blue color light source, 7: Green color light source, 8: Red color light source, 9: Lens array, 10: Light receiving element, P: Manuscript

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Figure 1 is a simplified diagram of the composition of an embodiment of the manuscript reading device (see the translation of legend given above).

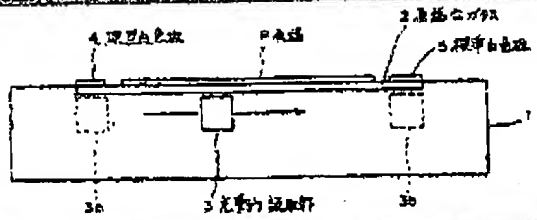


Figure 2 is a simplified diagram of the composition of the optical reader in Figure 1 (see the translation of legend given above).

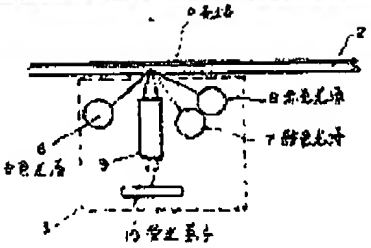


Figure 3: a timing chart that explains the method for correcting the manuscript reading operation and read signals in this embodiment.

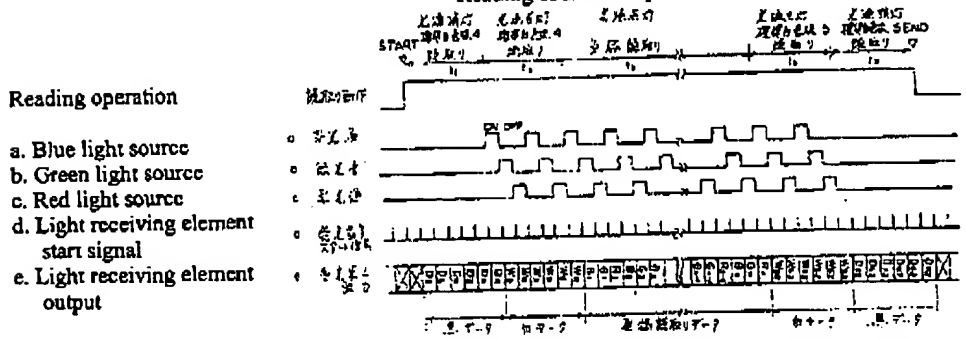
[J. words above t_1] Light source turned off
Standard white plate 4
Reading

[J. words above t_2] Light source turned on
Standard white plate 4
Reading

[J. words above t_3] Light source turned on
Reading of manuscript

[J. words above t_4] Light source turned on
Standard white plate 5
Reading

[J. words above t_5] Light source turned off
Standard white plate 5
Reading



[J. words for arrow lines from left to right: black data; white data; manuscript read data; white data; black data]

⑲日本国特許庁(JP)

⑪特許出願公開

⑫公開特許公報(A)

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明細書

1．発明の名称

原稿読取装置

2．特許請求の範囲

対象物に光を照射する光源と、

上記光源により光照射された対象物からの反射光を検出し、この検出した光量に応じた値の絵素出力を発生する読取手段と、

上記対象物に対して上記読取手段を相対的に移動させる移動手段とを有する原稿読取装置において、

原稿読取り開始前に上記読取手段により読取られる第一の基準板と、

原稿読取り終了後に上記読取手段により読取られる第二の基準板と、

原稿読取り開始前に上記光源を点灯させ上記第一の基準板を読取ったときの上記読取手段の絵素出力値をW_1、原稿読取り終了後に上記光源を点灯させ上記第二の基準板を読取ったときの上記読取手段の絵素出力値をW_2、原稿読取り開始前に上記光源を消灯させ上記第一の基準板を読取ったときの上記読取手段の絵素出力値をD_1、原稿読取り終了後に上記光源を消灯させ上記第二の基準板を読取ったときの上記読取手段の絵素出力値をD_2、上記光源を点灯させ原稿を読取ったときの上記読取手段の絵素出力値をV_i、所定の定数をAとしたときに、補正後の絵素出力値を次式

$$V = \frac{A\{V_i - (D_1 + D_2)/2\}}{\{(W_1 + W_2)/2\} - \{(D_1 + D_2)/2\}}$$

で算出される値Vに補正する補正手段とを有することを特徴とする原稿読取装置．

3．発明の詳細な説明

〔産業上の利用分野〕

本発明は、光源により原稿に光を照射し画像を読取る原稿読取装置に関するものである．

〔従来の技術〕

従来のこの種の原稿読取装置における出力補正方法としては、特公昭61-14702号公報に開示されたものがある．この方法は、デジタル化

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された イメージセンサの各絵素出力のうち、原稿白色板に一定光量を照射したときの絵素出力値を D_{iw}、原稿白色板に光を照射しないとき（暗時）の絵素出力値を D_{id}、原稿を読取ったときの絵素出力値を D_i、所定の定数をAとしたときに、イメージセンサの絵素出力値を下記の式（1）で表されるDとする補正方法であり、

$$D = A(D_i - D_{id}) / (D_{iw} - D_{id}) \quad \cdots式(1)$$

イメージセンサの各絵素間の出力ばらつきを小さくするためのものである。

〔発明が解決しようとする課題〕

しかしながら、上記式（1）の補正を行う従来の原稿読取装置においては、以下に示す問題があった。

例えば、光源としてLEDを用いLEDを連続的に点燈させた場合には、LEDの温度が上昇し、負の温度特性を有するLEDの発光出力が低下してしまう。このため、読取り開始時に原稿白色板を読取って基準となる絵素出力値 D_{iw} を採取していても、点灯時間の経過とともに、読取り終了時にはLEDの発光出力が低下し、読取り終了時の原稿読取り結果が暗くなってしまう問題があった。

また、光源として蛍光管を用い蛍光管を連続的に点燈させた場合には、蛍光管の温度が上昇し、正の温度特性を有する蛍光管の発光出力が点灯時間の経過とともに増加する。このため、読取り終了時の発光出力が増加し、読取り終了時の原稿読取り結果が明るくなり過ぎる問題があった。

そこで、本発明は上記したような従来技術の課題を解決するためになされたものであり、その目的とするところは、光源の温度特性を考慮した出力の補正をすることによって、精度の高い画像読取りをすることのできる原稿読取装置を提供することにある。

〔課題を解決するための手段〕

本発明に係る原稿読取装置は、対象物に光を照射する光源と、上記光源により光照射された対象物からの反射光を検出し、この検出した光量に応じた値の絵素出力を発生する読取手段と、上記対象物に対して上記読取手段を相対的に移動させる移動手段とを有する原稿読取装置において、原稿読取り開始前に上記読取手段により読取られる第一の基準板と、原稿読取り終了後に上記読取手段により読取られる第二の基準板と、原稿読取り開始前に上記光源を点燈させ上記第一の基準板を読取ったときの上記読取手段の絵素出力値を W_1、原稿読取り終了後に上記光源を点燈させ上記第二の基準板を読取ったときの上記読取手段の絵素出力値を W_2、原稿読取り開始前に上記光源を消灯させ上記第一の基準板を読取ったときの上記読取手段の絵素出力値を D_1、原稿読取り終了後に上記光源を消灯させ上記第二の基準板を読取ったときの上記読取手段の絵素出力値を D_2、上記光源を点灯させ原稿を読取ったときの上記読取手段の絵素出力値を V_i、所定の定数をAとしたときに、補正後の絵素出力値を次式（2）

$$V = \frac{A(V_i - (D_1 + D_2)/2)}{((W_1 + W_2)/2) - ((D_1 + D_2)/2)} \quad \cdots式(2)$$

で算出される値Vに補正する補正手段とを有することを特徴としている。

〔作　用〕

本発明においては、原稿の読取り開始前に第一の基準板を光源点灯及び消灯の両方の状態で読取り、また、原稿読取り終了後に第二の基準板を光源点灯及び消灯の両方の状態で読取る。そして、光源を点燈させ第一の基準板を読取ったときの読取手段の絵素出力値を W_1、光源を点燈させ第二の基準板を読取ったときの読取手段の絵素出力値を W_2、光源を消灯させ第一の基準板を読取ったときの読取手段の絵素出力値を D_1、光源を消灯させ第二の基準板を読取ったときの読取手段の絵素出力値を D_2、原稿を読取ったときの読取手段の絵素出力値を V_i、所定の定数をAとしたときに、補正後の絵素出力値を上記式（2）で算出さ

れる値Vに補正している。このように、原稿読取り前後に標準板の読取り情報を採取して、これに基づき絶対出力値を補正しているので、光源の温度上昇による発光量の変化をも考慮した読取信号の補正が行われる。

〔実施例〕

以下に本発明を図示の実施例に基づいて説明する。

第1図は本発明に係る原稿読取装置の一実施例である光源切換型カラー原稿読取装置を示す概略構成図である。

同図に示されるように、本実施例の原稿読取装置は、装置本体1の上面に原稿Pを載置させる原稿台ガラス2を備えており、また装置本体1内の原稿台ガラス2下部にはベルト駆動機構等の移動手段（図示せず）により矢印方向に移動し原稿Pの画像を読取る光学的読取部3が備えられている。さらに、本実施例は原稿台ガラス2上であって、光学的読取部3の原稿読取り開始前位置（図に破線で示す3a）と原稿読取り終了後位置（図に破線で示す3b）との上方にそれぞれ標準白色板4，5を備えている。

第2図は第1図の光学的読取部3を示す概略構成図である。

同図に示されるように、光学的読取部3は原稿Pを照明する青色光源6と、緑色光源7と、赤色光源8とを有すると共に、原稿Pからの反射光を集光させるレンズアレイ9と、これにより集光された反射光を受光するCCDよりなる受光素子10とを有している。

第3図は本実施例の原稿読取り動作及び読取り信号の補正方法を説明するためのタイミング図である。

第1図乃至第3図に基づいて本実施例の動作を説明すると、

先ず、第3図に示されるSTART時点から読取り動作が開始されると、期間t_1において光源6，7，8を消灯させて標準白色板4を受光素子10で読取り青色、緑色、赤色成分の黒データ（出力値D_{B1}，D_{G1}，D_{R1}）を出力する。

次に、期間t_2において、第3図のa乃至cに示されるように、光源6，7，8を順に点灯させて標準白色板4を受光素子10で読取りの青色、緑色、赤色成分の白データ（出力値W_{B1}，W_{G1}，W_{R1}）を出力する。

次に、期間t_3において、第3図のa乃至cに示されるように、光源6，7，8を順に点灯させて原稿Pを受光素子10で読取り青色、緑色、赤色成分の画像データ（出力値B_i，G_i，R_i，iは読取りライン数）を出力する。

原稿読取り終了後に、期間t_4において、第3図のa乃至cに示されるように、光源6，7，8を点灯させて標準白色板5を受光素子10で読取り青色、緑色、赤色成分の白データ（出力値D_{B2}，D_{G2}，D_{R2}）を出力する。

次に、期間t_5において、光源6，7，8を順に消灯させて標準白色板5を受光素子10で読取り青色、緑色、赤色成分の黒データ（出力値W_{B2}，W_{G2}，W_{R2}）を出力して、END時点となり読取りを終える。

期間t_1，t_2，t_4，t_5において出力された補正用データ及び期間t_3において出力された画像データは、図示しない補正回路に送出され、原稿を読み取った画像データを各色成分毎に下記の式（3），（4），（5）により補正演算を行う。尚、ここでAは所定の定数である。

青色成分：

$$V_{Bi}=\frac{A\{B_i-(D_{B1}+D_{B2})/2\}}{\{(W_{B1}+W_{B2})/2\}-\{(D_{B1}+D_{B2})/2\}} \quad \cdots式(3)$$

緑色成分：

$$V_{Gi}=\frac{A\{G_i-(D_{G1}+D_{G2})/2\}}{\{(W_{G1}+W_{G2})/2\}-\{(D_{G1}+D_{G2})/2\}} \quad \cdots式(4)$$

赤色成分：

$$V_{Ri}=\frac{A\{R_i-(D_{R1}+D_{R2})/2\}}{\{(W_{R1}+W_{R2})/2\}-\{(D_{R1}+D_{R2})/2\}}$$

…式(5)

以上のように、原稿読取り前後に標準白色板の読取り情報を採取して、これに基づき原稿読取りデータに対して補正された結果出力値V_{Bi}、V_{Gi}、V_{Ri}を得る事ができるので、光源の逐次的点灯により光源の発光量が徐々に変化したとしても、この光量変化をも考慮した読取データ信号の補正を行うことができ、光源の発光パワーの差より生ずる読取り画像の色の誤差を改善できる。

尚、期間t_1、t_2・t_4、t_5において1出力された補正用のデータは、実際には複数ライン分の出力の平均によって決められる値であるが、第3図においては、2ライン分読取った場合を示す。

また、上記実施例においては、カラー原稿読取装置を例にして説明したが、LEDやけい光灯など温度特性を有する光源を用いた白黒用の原稿読取装置においても適用できる。

〔発明の効果〕

以上説明したように、本発明によれば、原稿の読取り開始前と終了後とに、それぞれ光源点灯及び消灯状態における補正データを採取し、これに基づく補正を行うので、光源の発光量の温度変化が原稿読取り途中で生じても、読取りデータの誤差を改善でき、精度の高い画像読取りを行うことができるという効果を有する。

4．図面の簡単な説明

第1図は本発明に係る原稿読取装置の一実施例を示す概略構成図、

第2図は第1図の光学的読取部の構成図、

第3図は本実施例の動作を示すタイミング図である。

1…装置本体、　2…原稿台ガラス、
3…光学的読取部、　4，5…標準白色板、
6…青色光源、　7…緑色光源、
8…赤色光源、　9…レンズアレイ、
10…受光素子、　P…原稿。

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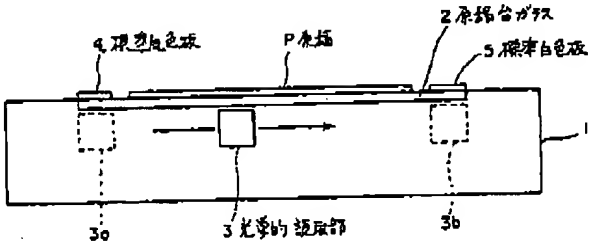
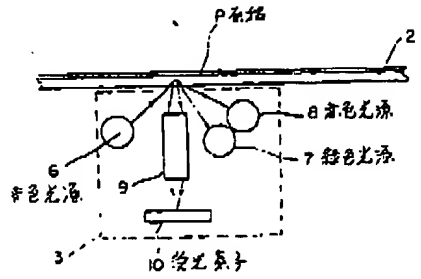


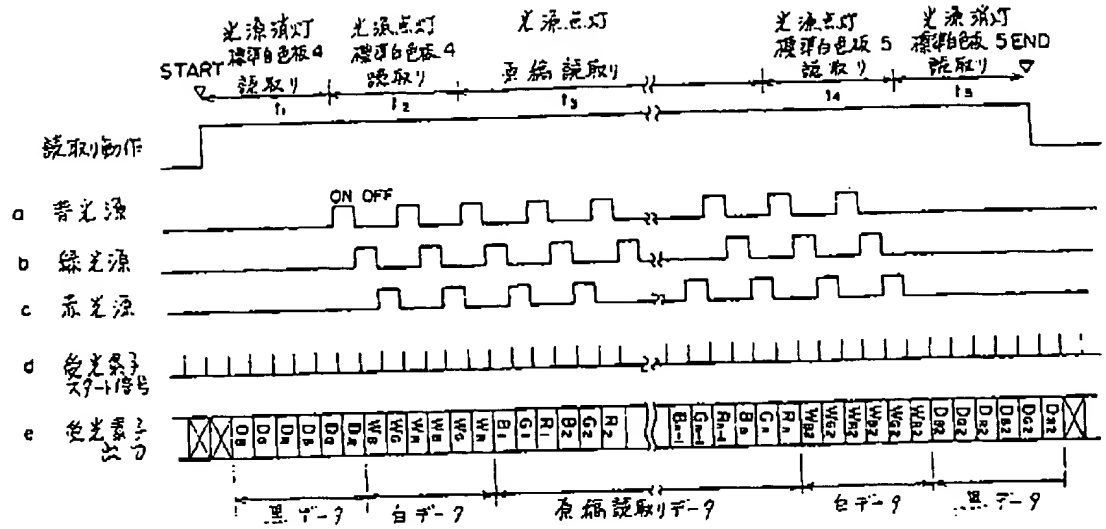
本実施例の原稿読取装置を示す概略構成図

第1図



第1図の光学的読取部3とその概略動作

第2図



本実施例の原稿読取り動作及び読取り信号の補正方法を示すタイミング図

第 3 図